

NRC / VIC / Visual Ergonomics  
Pekka Pihlaja



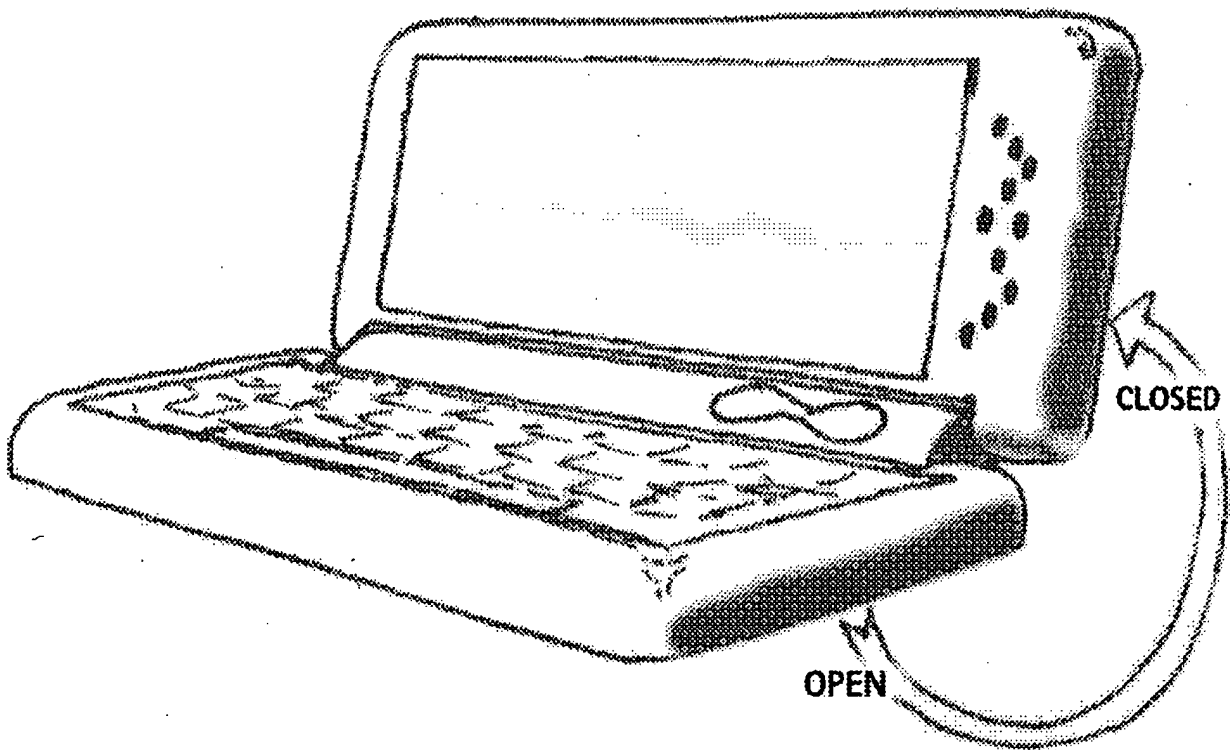
**New Form Factor for the Communicator**  
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**Summary**

For convenience the invention will hence be referred to as **Belinda**, which stands for Better Linda.

In the closed position Belinda has a large display on its front surface, and the graphical user interface is operated with middle- or forefinger(s) on a touchpad, which takes up the whole back surface of Belinda. Belinda is opened by swinging the touchpad nearly 270 degrees, so that it will end up where the keyboard is in the present communicator when opened. The touchpad has an image of a keyboard printed on it, and it can be used for text input by switching it to keyboard-mode.

In essence the invention is that in the closed position there is a touchpad-keyboard on the back surface of the device for pointing, and for the open position it is swung near 270 degrees to be used as a keyboard.



**Illustration: Belinda in its open position**

**Background**

Belinda form factor enables combining three input methods currently being developed at Nokia. Belinda would make the Communicator thinner and more functional in the closed position. The input methods utilized in Belinda are:

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### 1. A combination touchpad-keypad

This is basically a touchpad with (an image of) a keypad printed on it. It has two operating modes; one for pointing and one for text/numerics input. This method is being developed in the Southwood PC Center.

(I think the prototype developed in Southwood had domes under the keys. I don't know if the touchpad was used to detect keypresses as is proposed here. If domes are used, the touchpad-keypad does not need separate operating modes for pointing and text input.)

### 2. A thin keyboard with piezoelectric tactile feedback

This thin keyboard has a smooth surface with (an image of) a keyboard printed on it. A piezoelectric component gives a gentle mechanical tap on the user's finger when a keypress is detected. The usability of the keyboard is greatly enhanced by this feature. The system is being developed in the Mechanics Group of NRC/Helsinki.

### 3. A touchpad on the back surface of the device

The display takes up the whole front surface of the device. The graphical user interface is controlled with a touchpad placed on the back surface of the device. The touchpad is operated with the fore- or the middlefinger(s). A Select-key can be placed on the front surface of the device. If the touchpad is force sensitive a Select-key is unnecessary. The method is being developed in the Usability Group of NRC/Helsinki.

Nokia has already developed a device very similar to Belinda, known as Colorado. Evidently the main difference between the two is that Colorado has a conventional mechanical keyboard whereas Belinda uses a touchpad-keyboard. The benefit of using a touchpad-keyboard is that its touchpad functionality can be fully utilized even when it is folded to the back of the device. The differences of Colorado and Belinda will be clarified in a forthcoming supplement.

## **Detailed Description**

### 1. The open position

The illustration (page 1) depicts Belinda in the "open" position. The touchpad-keyboard can be used for pointing and text input. The open position corresponds to the open position of the present Communicator. When the touchpad-keyboard is switched to touchpad mode the whole of its area is available for pointing, which should make pointing much easier than with the present joystick.

### 2. The closed position

In the "closed" position the touchpad-keyboard is folded to the back of the device and can be used for pointing with the fore- or middle finger(s). Even though the finger controlling the cursor is behind the device and invisible to the user, she can "feel" where her fingertip is through the sense of proprioception, the sense of position and movement of limbs and body.

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When moving the cursor (with Belinda in the closed position) the user should get a feeling that the back of the cursor actually fastened to her fingertip and that she can move the cursor at will.

In order to get such pointing action it is required that the touchpad is the same size or bigger than the display. For enhanced usability, the edges of the touchpad should coincide with the edges of the display in the closed position. The edges of the touchpad should also be slightly raised from the surface, so that the user can feel them with her fingers. This feature will aid the user's eye-hand coordination. It will also be helpful when Belinda is used in the open position.

The user's thumbs are fairly free to move on the front surface. Keys can be placed on the rims of the front surface for the Select-function etc.. Alternatively hard keys can be replaced with position sensitive sensor strips which NRC/Helsinki is currently developing. Position sensitive strips can be used for selecting, scrolling and zooming. They can also be used for full 2D-pointing by using the FRAME input method developed in the Visual Ergonomics Group of NRC/Helsinki.

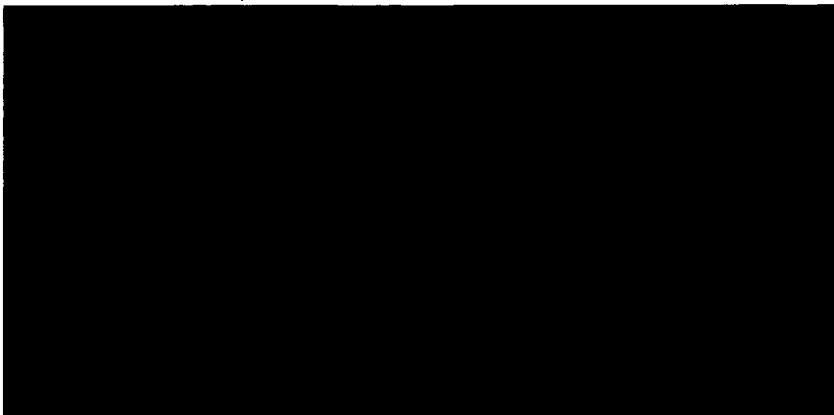
### 3. The optional "covered" position

The touchpad-keyboard can be made to fold all the way to the other direction as well, so that it can be closed also with the touchpad-keyboard facing the display. This way the display is protected and would not need a protective window. Protective windows induce specular reflections and deteriorate image quality. In the belt holster the device could still be carried with the display outwards to allow fast access.

Incorporating the covered position imposes constraints to the industrial design of Belinda. However, it should be claimed in a prospective patent application.

#### Benefits of Belinda:

- The big display is always visible
- Fast access to all functions in the closed position. Even provisory text input is possible with a soft keyboard.
- Good keyboard
- Absolute position control of the cursor
- Thin construction. The touchpad-keyboard half of the device can be made really thin, like a flap. However, in this case the display half would need a folding leg to keep it upright on the table.



List of acronyms used:

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Belinda: Better Linda ( Belinda is originally an Italian name and means "beautiful")

**Keywords :**

Communicator  
touchpad  
keyboard  
display  
pointing  
folding  
tactile  
piezo